

**REMARKS**

This is a full and timely response to the Office Action mailed January 18, 2008, submitted concurrently with a one month extension of time to extend the due date for response to May 19, 2008.

By this Amendment, claims 1, 3 and 6 have been amended to put the claims in better form under U.S. practice, to address the rejection under 35 U.S.C. §112, second paragraph, and to more particularly define the present invention. Further, new claims 8-12 have been added to further protect specific embodiments of the present invention. Thus, claims 1-12 are currently pending in this application.

Support for the claim amendments and new claims can be readily found variously throughout the specification and the original claims. More specifically, claim 8 is supported by the second full paragraph on page 6, the second to fourth paragraphs on page 8, and the second full paragraph on page 9 of the specification. Further, claim 9 is supported by the first full paragraph on page 10. Lastly, support for claims 10-12 can be found in the fourth and fifth paragraphs on page 8 of the specification.

In view of these amendments, Applicant believes that all pending claims are in condition for allowance. Reexamination and reconsideration in light of the above amendments and the following remarks is respectfully requested.

**Objection to the Specification**

The specification has been objected to for not disclosing how a concentration [C] in g/L multiplied by mPa-s results in a viscosity in terms of mPa-s. Applicant believes that the explanation set forth below in Applicant's response to the rejection under 35 U.S.C. §112, second paragraph, overcomes this objection.

**Rejection under 35 U.S.C. §112**

Claim 1-7 are rejected under 35 U.S.C. §112, second paragraph, for allegedly being indefinite. Applicant believes that the amendments to the claims overcome this rejection by putting the claims in better form under U.S. practice and addressing the Examiner's specific concerns

outlined in the action. More specifically, the claims have been amended to (1) define method steps (2) clarify that the range of viscosity is calculated using a formula (" $0.12 \times [C]$ " and " $0.06 \times [C]$ ") wherein  $[C]$  denotes the value of the  $\text{SiO}_2$  concentration (see sentence bridging pages 3 and 4 of the specification) and (3) to address the insufficient antecedent basis of the phrase "*the high concentration range*" by amending the phrase to --the high  $\text{SiO}_2$  concentration--

With regard to the Examiner's rejection of claim 4 for the insufficient antecedent basis of the phrase "*the high concentration silica sol*", Applicant respectfully traverses this portion of the rejection since proper antecedent basis for this phrase is provided in line 3 of claim 3.

With regard to the formula (" $0.12 \times [C]$ " and " $0.06 \times [C]$ " wherein  $[C]$  denotes the value of the  $\text{SiO}_2$  concentration) which is use to calculate the range of viscosity in the claims, Applicant wishes to note the following for the Examiner information.

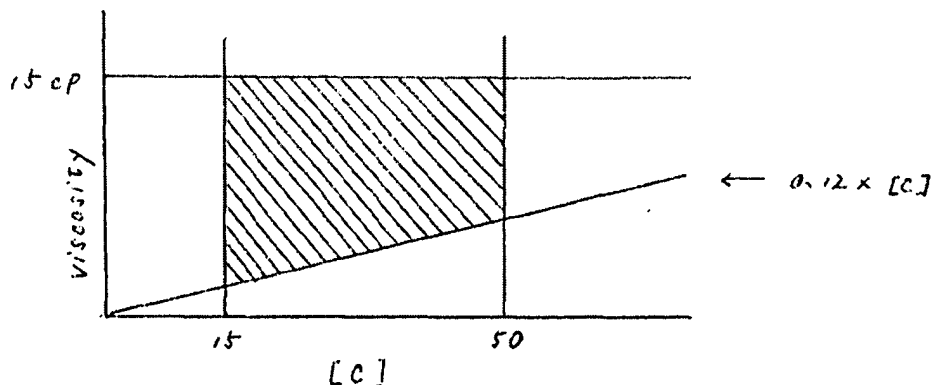
The required properties of the silica sol were found by the Applicants during experiments. The inventors plotted a graph, with the concentration as abscissa and the viscosity as ordinate. The requirements "*with a  $\text{SiO}_2$  concentration from 15 to 50 g/L and a viscosity from  $(0.12 \times [C])$  mPa·s to 15 mPa·s measured at  $25^\circ\text{C}$  under the  $\text{SiO}_2$  concentration, wherein  $[C]$  denotes a value of the  $\text{SiO}_2$  concentration*" mean the area defined by the following four lines on the coordinate:

$$X = 15 \text{ (g/L)}$$

$$X = 50 \text{ (g/L)}$$

$$Y = 0.12X \text{ (mPa}\cdot\text{s)} \text{ (In this equation, } X = [C]\text{.)}$$

$$Y = 15 \text{ (mPa}\cdot\text{s)}$$



In other words, the silica sol defined in claim 1 has a concentration and a viscosity within the area of the oblique lines above. Thus, Applicant believes that the properties of the silica sol, which are defined by its concentration limits and viscosity limits, can be clearly understood by one skilled in the art, since  $[C]$  denotes the value of the concentration.

### **Rejection under 35 U.S.C. §102**

Claims 1, 2, 4, 6 and 7 are rejected under 35 U.S.C. §102(b) as allegedly being anticipated by Keiser et al. (U.S. Patent No. 6,372,089). Applicant respectfully traverses this rejection.

To constitute anticipation of the claimed invention under U.S. practice, the prior art reference must literally or inherently teach each and every limitation of the claims. Here, in this case, Applicant believes that Keiser et al. fails to teach all the limitations of the claims with particular emphasis on the limitations “*a silica sol with a  $\text{SiO}_2$  concentration from 15 to 50 g/L and a viscosity from  $(0.12 \times [C])$  mPa·s to 15 mPa·s measured at 25°C under the  $\text{SiO}_2$  concentration wherein  $[C]$  denotes a value of the  $\text{SiO}_2$  concentration*”, “*diluting the high concentration silica sol prior to storage*”.

The Examiner has rejected claims 1, 2, 4, 6 and 7 as being anticipated by Keiser et al. on the basis that the reference teaches in Example 3 a silica sol having a viscosity of 2.9 centipoises and a pH of 2.76 which the Examiner believes reads on the limitations of the claims (see column 11, lines 37-38 of Keiser et al.). However, Applicant strongly disagrees with the Examiner in this regard.

The properties noted by the Examiner are those of an aqueous silicic acid, which is a reactant, and not a product. This reactant, aqueous silicic acid, is not a colloidal silica sol that is used in the production of paper. Further, the properties of this aqueous silicic acid do not satisfy the property limitations recited in claim 1. Specifically, the concentration in g/L of this aqueous silicic acid, calculated from the  $\text{SiO}_2$  concentration of 6.37% by weight and the specific gravity of 1.0388 written in column 11, lines 37-38, of Keiser et al., is 6.61 g/L which is outside the claimed range of 15 to 50 g/L defined in the claims. Moreover, the measured actual viscosity of the aqueous silicic acid, 2.9 centipoises (2.9 centipoises = 2.9 mPa·s), is also outside the claimed range of  $(0.12 \times [C])$

mPa•s to 15 mPa•s defined in the claims. In order for the viscosity of the aqueous silicic acid to satisfy the requirements of the claim 1, the viscosity must be at 7.9 mPa•s, calculated from the concentration value of 6.61 g/L and the formula recited in the claims. Thus, neither the concentration nor the viscosity of the aqueous silicic acid or reactant of Keiser et al. satisfies the requirements of the claims.

It should also be further noted that the properties of the product of EXAMPLE 3, i.e. a colloidal silica composition for use in the production of paper, are found in column 11, lines 55-59, of Keiser et al. The disclosed colloidal silica composition has a silica concentration of 14.8-16.6% by weight and a specific gravity of 1.1033. The concentration of such a product in g/L, calculated from these data, is from about 168 to 183 g/L which is much higher than the concentration of the silica sol of claims 1, 2 and 4.

Similarly, the retention aid of claim 6 has a low concentration from 15 to 50 g/L, but shows a high viscosity. In contrast, the colloidal silica composition, used as a retention aid, obtained in EXAMPLE 3 of the Keiser et al. has a high concentration from 168 to 183 g/L. Therefore, the concentration of the retention aid of claim 6 is different from that of Keiser et al. If Keiser et al.'s colloidal silica composition, which does not show an increase in the viscosity even at the high concentration (which will be explain herein below), is diluted to such a low concentration of 15 to 50 g/L, the viscosity will be much lower than in the present claims.

Hence, since Keiser et al. fails to teach a silica sol and retention aid with the properties specified in claims 1, 2, 4, 6 and 7, these claims are neither anticipated by nor obvious over the teachings and suggestions of Keiser et al. Thus, for these reasons, withdrawal of the present rejection is respectfully requested.

#### **Rejection under 35 U.S.C. §103**

Claims 3 and 5 are rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Keiser et al. (U.S. Patent No. 6,372,089). Applicants respectfully traverse this rejection.

To establish a *prima facie* case of obviousness, the cited reference must teach or suggest the invention as a whole, including all the limitations of the claims. Here, in this case, Keiser et al. fails to teach or suggest the claim limitations "*a silica sol with a SiO<sub>2</sub> concentration from 15 to 50*

*g/L and a viscosity from  $(0.12 \times [C])$  mPa·s to 15 mPa·s measured at 25°C under the SiO<sub>2</sub> concentration wherein  $[C]$  denotes a value of the SiO<sub>2</sub> concentration”, “preparing a high concentration silica sol which has a high SiO<sub>2</sub> concentration  $[C]$  ranging between 100 g/L and 200 g/L, and has a viscosity from  $(0.06 \times [C])$  mPa·s to 30 mPa·s under the high SiO<sub>2</sub> concentration”, “diluting the high concentration silica sol prior to storage”, and “the silica sol is further diluted before adding to the pulp slurry”.*

First, claims 3 and 5 depend from claims 1 or 2 and include all of the features of claim 1 or 2. Thus, the dependent claims are allowable at least for the reasons claim 1 or 2 is allowable (see above) as well as for the features they recite.

With regard to such features, Applicant submits that Keiser et al. fails to teach diluting the resulting high-concentration product. High concentration silica sol according to the present invention is very unstable and apt to polymerize further. Therefore, if this high concentration silica sol is stored as is, it will gel and become useless in a short time. In other words, it is too late if such high concentration silica sol is diluted just before the addition to pulp slurry. It has to be diluted prior to storage. Since a high concentration silica sol tends to further polymerize as mentioned above, it will accelerate polymerization and then production. The produced high concentration silica sol is diluted subsequently, in order to prevent its further excessive polymerization and allow its stable storage.

Applicant wishes to direct the Examiner's attention to page 8, third paragraph, of the present specification which explains the importance of the SiO<sub>2</sub> concentration range of 100 g/L to 200 g/L. Further, the importance of diluting silica sol to the SiO<sub>2</sub> concentration of 15 g/L to 50 g/L for storage is explained in the second full paragraph on page 9 of the specification.

Applicant wishes to reiterate and emphasize to the Examiner that Keiser et al. is completely silent about diluting their colloidal silica composition. In fact, the colloidal silica composition of Keiser et al. does not require diluting (please see the last sentence of EXAMPLE 3 in Keiser et al.). It states that after 51 days, the surface was measured to be 711.2 m<sup>2</sup>/g, which implies that they were able to store the product stably for 51 days without dilution.

This fact actually shows the major difference between the high concentration silica sol of the present invention and the colloidal silica composition of Keiser et al. If the colloidal silica

composition of Keiser et al. had been the same as the silica sol of the present invention, it would have gelled in a short time.

The inventors of the present invention believes that polymerization, the progress of which leads to an increase in the viscosity, seldom takes place in Keiser et al.'s colloidal silica composition. Although the colloidal silica composition has a high concentration of 168 to 183 g/L, it never polymerizes but remains just a "colloidal silica". In contrast, the high concentration silica sol of the present invention has high polymerizability. This high polymerizability makes it possible to produce a high concentration silica sol with a controlled polymerization degree, as well as in bulk in a short time.

With respect to the Examiner's argument in the office action that it would have been obvious to one skilled in the art to obtain silica sol of high concentration to save on transportation costs, Applicant believes that based on such logic, the skilled artisan would also have diluted silica sol of high concentration just before use to save on storage costs. However, it is clearly stated in amended claim 3 that the high concentration silica sol is diluted prior to storage to prevent excessive polymerization of the silica sol and allow for its stable storage. Therefore, it is clear that the production and dilution of the high concentration silica sol prior to storage is not done for economical reasons but for the technical reasons explained above. Hence, Applicant believes that the invention of amended claim 3 is not obvious from the disclosure of Keiser et al. based on the economical reasons noted by the Examiner.

Thus, for these reasons, withdrawal of the present rejection is respectfully requested.

With regard to new claims 8-12, Applicant believes that these new claims are distinguishable from that which is disclosed in Keiser et al. for also the reasons noted above.

In the inventions of claim 8 and its dependent claims, aging, or polymerization carried out under high SiO<sub>2</sub> concentration produces polymers with polymerization degrees appropriate for the retention aid. Silica sol of high concentration is apt to polymerize further for the reasons explained above. The resultant high concentration silica sol including such ideal polymers is then diluted to a silica sol with a lower concentration, which will be stored or used. In contrast, Keiser et al. is completely silent about aging after preparing a high concentration silica sol precursor and a

high concentration silica sol, produced through the aging, with excellent properties including the specified viscosity.


Therefore, Applicant submits that new claim 8 and the claims dependent thereto (i.e. new claims 9-12) are also patentable over Keiser et al.

### CONCLUSION

For the foregoing reasons, all the claims now pending in the present application are believed to be clearly patentable over the outstanding rejections. Accordingly, favorable reconsideration of the claims in light of the above remarks is courteously solicited. If the Examiner has any comments or suggestions that could place this application in even better form, the Examiner is requested to telephone the undersigned attorney at the below-listed number.

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